**Chapter 3 The Limiting Reagent and the theoretical and percentage yield Problem Set**

1. Questions 1-4 are based on the chemical equation provided below:

2FeCl3 (aq) + 3H2S (g) Fe2S3 (s) + 6HCl (aq)

1. For the reaction above, determine the limiting reactant if 100 g of FeCl3 is reacted with 50.0 g of H2S.

**Answer: FeCl3**

1. How many grams of HCl are formed?

**Answer: 67.4g HCl**

1. How many grams of which reactant will be left over when the reaction is complete?

**Answer: 18.6 g H2S**

1. What is the theoretical yield of Fe2S3that can be obtained?

**Answer: 64.0 g Fe2S3**

1. In the reaction 2AgNO3 + CaCl2 2AgCl + Ca(NO3) 2

How many grams of AgCl (Molar mass= 143.5) will precipitate when 20.0 g AgNO3 (molar mass=170) is reacted with 15.0 g CaCl2 (Molar mass =111) ?

**Answer: 16.9 g**

1. Identify the limiting reagent when 6.25 g of AgNO3 reacts with 4.12 g of NaCl to form NaNO3 and AgCl. What mass of AgCl will be produced?

**Answer: AgNO3 is the Limiting Reagent. 5.26g of AgCl will be produced.**

1. Aspirin (acetylsalicyclic acid) is prepared by heating salicylic acid, **C7H6O3**, with acetic anhydride, C4H**6**O3. The other product is acetic acid, C2H4O2.

**C7H6O3** + C4H**6**O3 C9H8O4 + C2H4O2

What is the theoretical yield (in grams) of aspirin, C9H8O4, when 2.00 g of salicylic acid is heated with 4.00 g of acetic anhydride? If the actual yield of aspirin is 1.98 g, what is the percentage yield?

**Answer: 2.61 g is the theoretical yield; 75.9%**

1. A 3.41g sample of a metallic element, M, reacts completely with 0.0158mol of a gas, X, to form 4.52 g MX. What are the identities of M and X? (Hint: Write the chemical equation)

**Answer: AgCl**

1. The following questions come from Spring 08 Chemistry 1 Midterm 1:
2. (A) How many hydrogen atoms are present in 10.0 g of ammonia (NH3)? Give your answer in individual hydrogen atoms, not moles. (B) How many grams of nitrogen are present?

**Answer: (A) 1.06 10^24 hydrogen atoms (B)8.22g nitrogen**

1. White (colorless) diamonds are composed of pure carbon in a solid lattice. Some diamonds found in nature are observed to have a color, which comes from a trace impurity in the lattice. In blue diamonds, the color comes from the replacement of a carbon atom with a boron atom in the lattice.
2. If one out of every 1000 carbon atoms is replaced by a boron atom, what is the percent by mass of boron in a blue diamond?
3. What is the empirical formula for the diamond described above?

**Answer: (A) 0.09% (B) BC999**